Space Weather Technical Forecast

Issued on Sunday 17 November 2024 at 12:59 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Daily Chance of R1. Slight Chance G1 in first half of forecast period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity measured at GOES16 has been Low during the past 24 hours, with a peak flare of C5.3 at 17/1059 UTC, which looks to have originated from a new and currently unnumbered sunspot emerging on the northeast limb. AR3889 also produced a C3.1 at 16/2202 UTC.

There are currently four numbered sunspot regions on the visible disc, with two unnumbered regions. The largest remains AR3889 in the southwest, however this showed a relatively open configuration and a reduction in the number of small spots surrounding the large penumbrae, with an overall reduction in area and complexity. A new bipolar region has developed to the immediate east of AR3889. Other regions are unipolar and largely unchanged. There is a new sunspot region beginning to emerge on the northeast limb, although this is currently very difficult to analyse.

No Earth-directed CMEs were observed over the past 24 hours in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE were indicative of a slow-regime, with solar winds reaching between 330-400km/s. The solar wind density was within typical background levels in single-figures ppcc, but showed a step upwards around 16/2000UTC, which was perhaps a resumption of a slow regime when considered with a concurrent fall in the IMF to near 5nT from earlier peaks of 8nT. The north-south component was mostly weak, peaking at -6nT. The phi angle was mostly positive (away from the Sun), but briefly re-orientated to negative between 17/1050 UTC and 17/1228 UTC.

The net result of the above solar wind measures was Quiet (0-2Kp) geomagnetic activity.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at Normal Background to Moderate levels, with a diurnal peak of 346pfu observed at 16/1810UTC. The associated 24-hour fluence remained below the Active threshold, and the 24-hour integrated flux observed at 16/2359UTC was a rising trend to 1.1e7.

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Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: There is a slightly higher Chance of both M and X-class activity relative to the recent past, with the arrival of a succession of returning regions expected over the eastern limb into the new UTC week.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast.

However, there a very low possibility of a glancing CME, from a filament lift-off from the southwest quadrant, which left the Sun on the 15 Nov, this should pass well ahead of Earth's orbit early on Day 2 (18 Nov). No impacts are expected from this feature.

The geomagnetic forecast therefore solely consists of an inbound coronal hole fast wind from CH92/+ mooted for later in the current UTC day. There is a corresponding Slight Chance of G1 Minor geomagnetic storm intervals resulting, with the risk waning before midweek UTC to Quiet.

Energetic Particles / Solar Radiation: There is a daily Slight Chance of S1/Minor solar radiation storms due to AR3889's position as it nears the western limb.

The high energy electron flux is expected to remain at predominantly background to moderate levels, although there is a chance of reaching High levels during diurnal peaks later in the period. The associated fluence will nevertheless most likely remain below Active (1e8 integrated flux).

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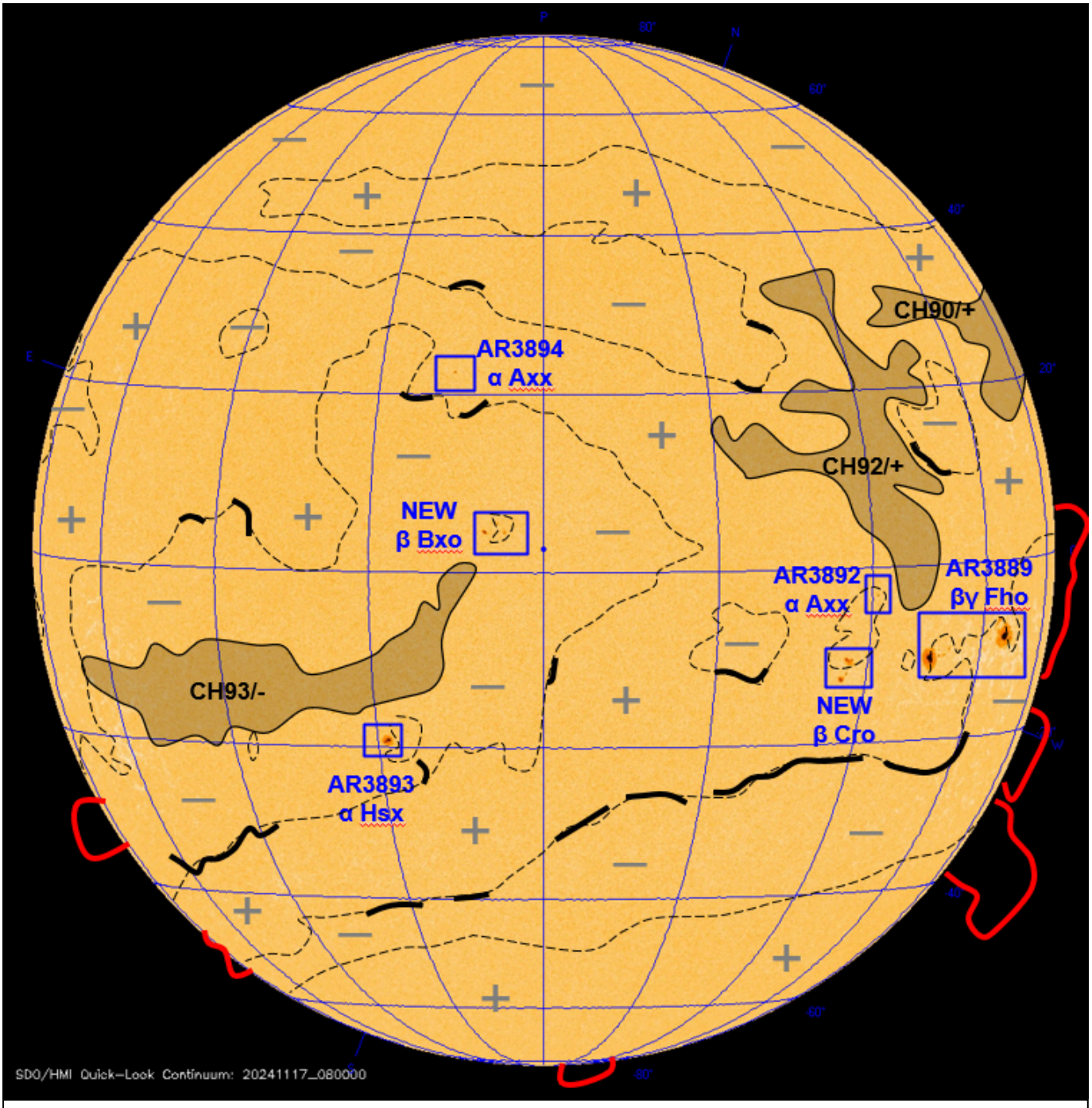
Figure 1: Solar analysis - valid 17/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No CMEs feature in the forecast. However, there a very low possibility of a glancing CME, from a filament lift-off from the southwest quadrant, on the 15 Nov, this should pass ahead of Earth's orbit early on Day 2 (18 Nov), although no impacts are expected from this feature.

In terms of coronal hole fast winds, there is a likelihood of elevated wind speeds of around 500km/s occurring later in the current UTC day with a connection to a HSS from CH92/+. This feature is slightly larger compared to last rotation, when speeds of around 450km/s occurred, and a general increase also suggested by MOSWOC Enlil output.

There is a corresponding Slight Chance of G1 partitioned between the first two UTC days of the period, waning through Day 3 (Tuesday 19 November) to become Quiet by midweek.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Figure 2: MOSWOC ENLIL - shows a very low probability of a glancing CME early on 18 Nov. Otherwise, HSS from CH92/+ is the main feature in the forecast.

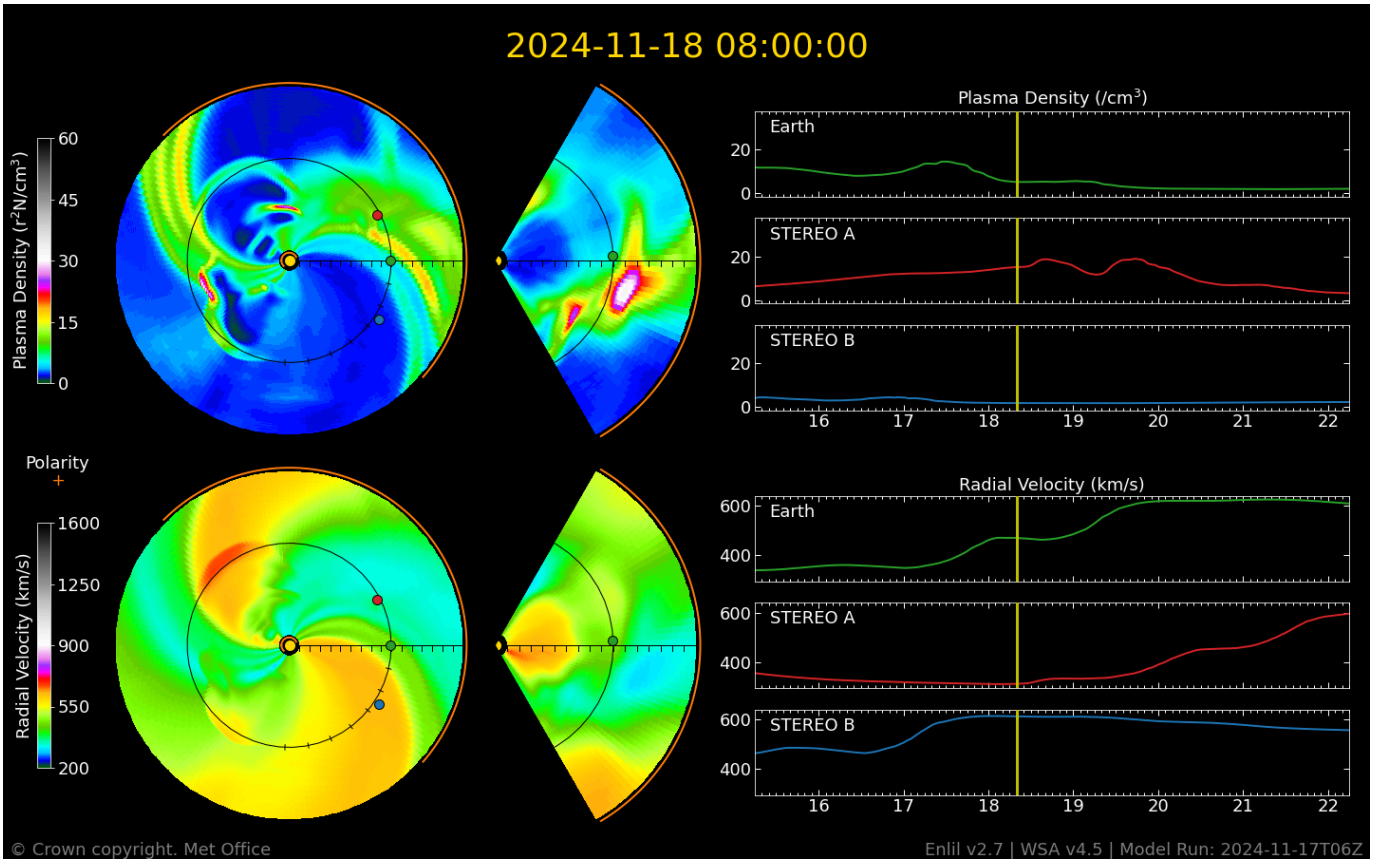

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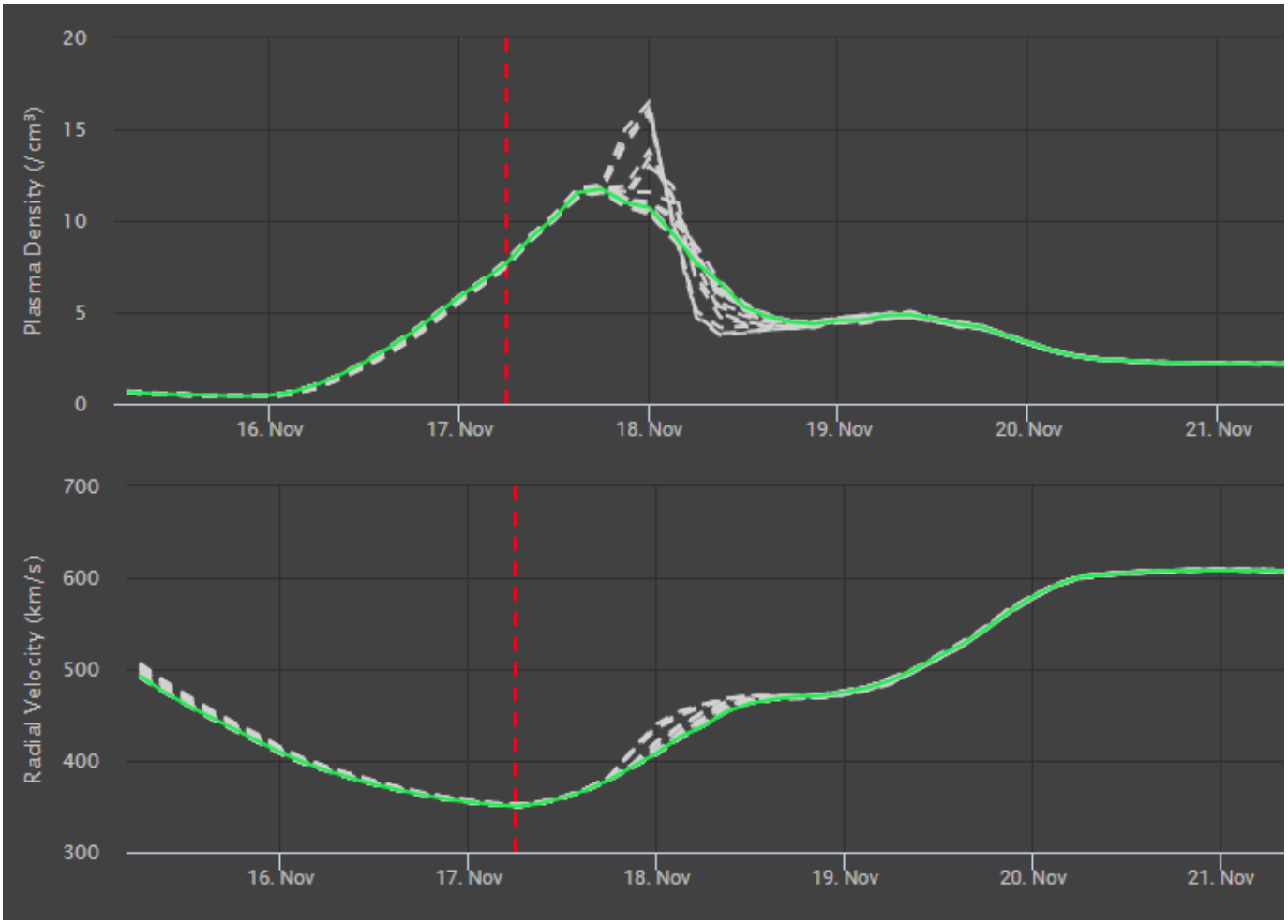
Figure 3: ENLIL Ensemble - shows a slight peak early 18 Nov, possibly due to a very low risk of glancing CME. Low confidence.



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Radio Blackouts - X-Ray Flares

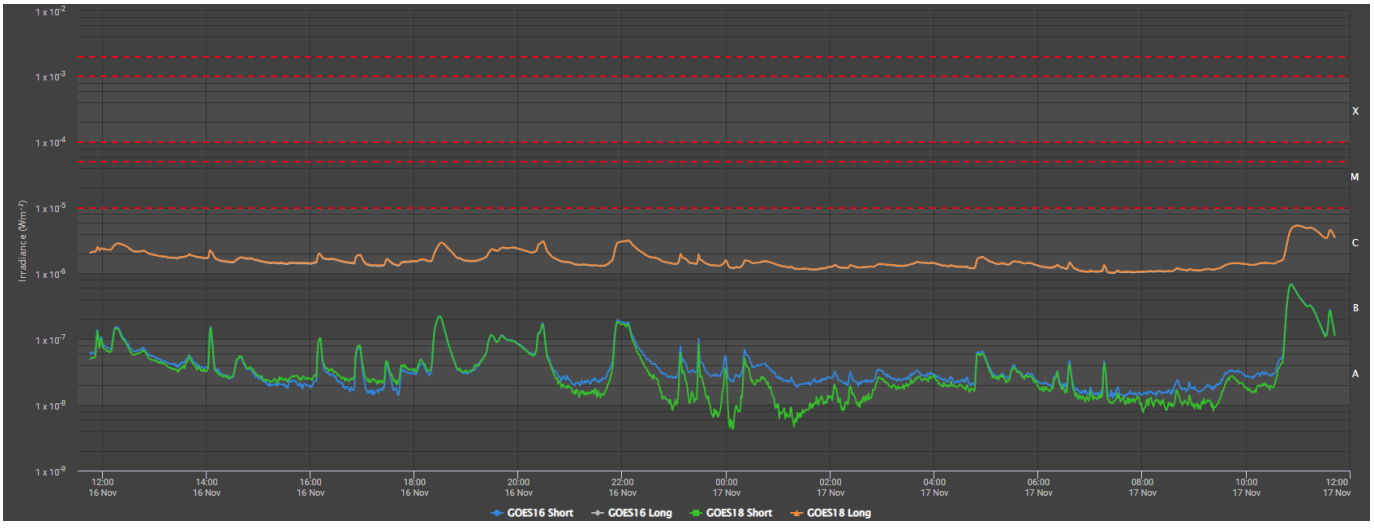
Of the current front-sided sunspot groups, AR3889 in the southwest maintains the bulk of the current flare risk, but has reduced somewhat given the recent simplification of the region. The remaining regions are small and magnetically simpler.

No particularly large far side regions are suggested by far-side sounding data, however these are clustered near the eastern limb and this minimises the signal from soundings. Recurrence instead suggests the potential for sunspot regions to return to the visible disc over the remainder of the UTC weekend. This is supported by brightening and magnetic looping on the eastern limb in SDO/AIA imagery and recent far-sided CMEs. There is also the presence of an emerging sunspot region on the east limb, which is currently difficult to analyse due to its close proximity to the east limb (on the horizon) and foreshortening.

Overall Low to Moderate activity is expected, with the arriving regions making for a now higher daily Chance of isolated M-class flares and a Slight Chance of X-class flares.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	40	40	40
Very Active	R3-R5 (X Class)	No	10	10	10	10

Figure 4: GOES16-18 X-Ray Flux trace



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Solar Radiation Storms (High Energy Protons)

There is a slight chance of S1/Minor Solar Radiation storms over the period, chiefly due to any potential significant flaring from AR3889 as it nears the western solar horizon. The series of inbound eastern limb regions are unlikely to present any appreciable risk to the daily probabilities of S1 for some time yet.

The changes in AR3889 to become a simplifying Fho group has resulted in a slightly lower risk relative to the recent past, still rising slightly to peak around midweek UTC when this spot group crosses the limb.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux at GEO may be suppressed later in the current UTC day by the onset of any fast wind from CH92/+. The expected rebound here by around Tuesday 19 November is unlikely to be of sufficient magnitude to trouble the Active 24-hour integrated threshold - no persistent feature on the disc has resulted in Active fluence. All considered, there is a slightly rising Slight Chance of Active fluence, peaking before midweek UTC.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	5
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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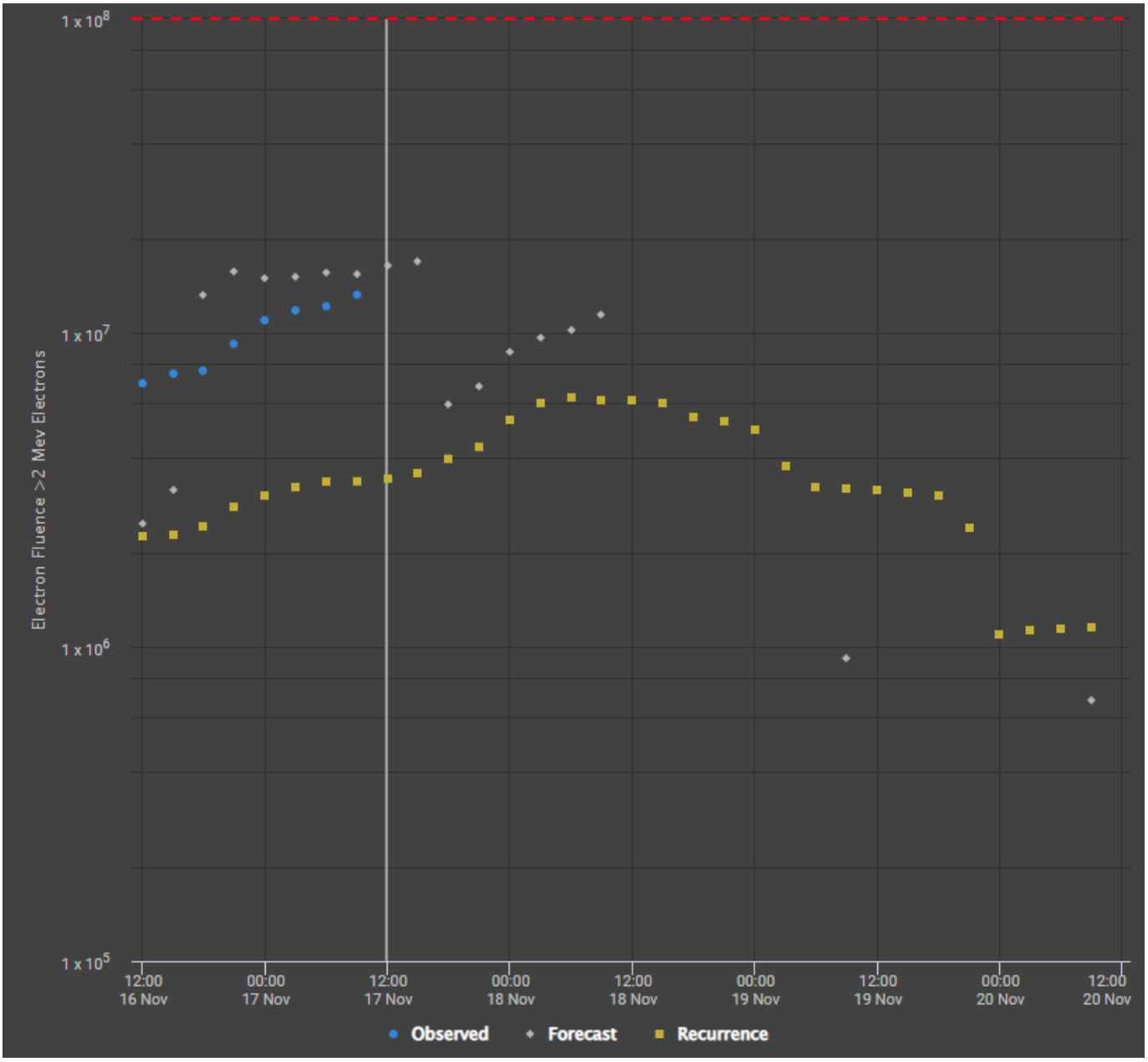
Figure 5: MOSWOC Electron fluence - observations, forecast and recurrence.



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